

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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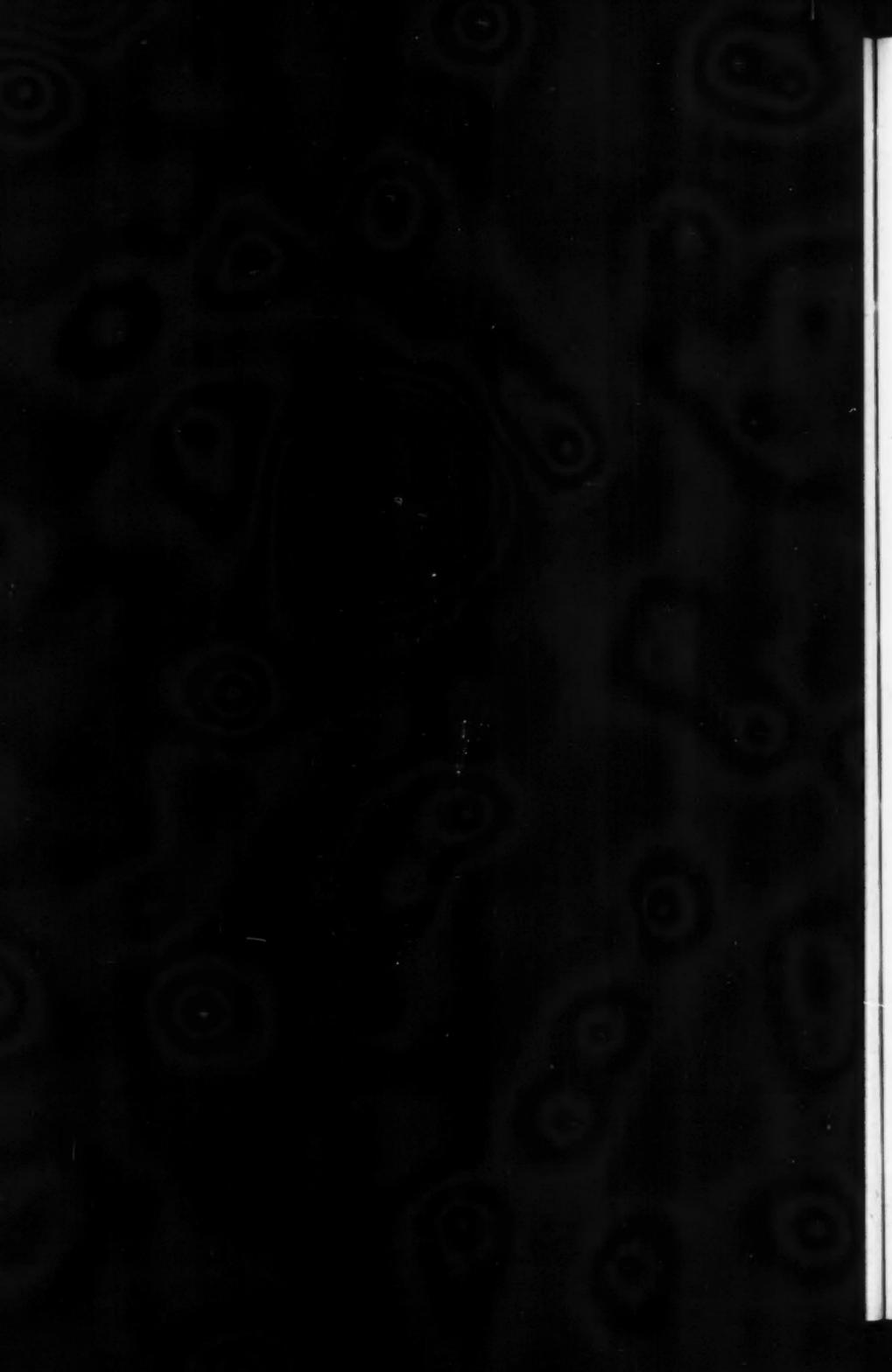
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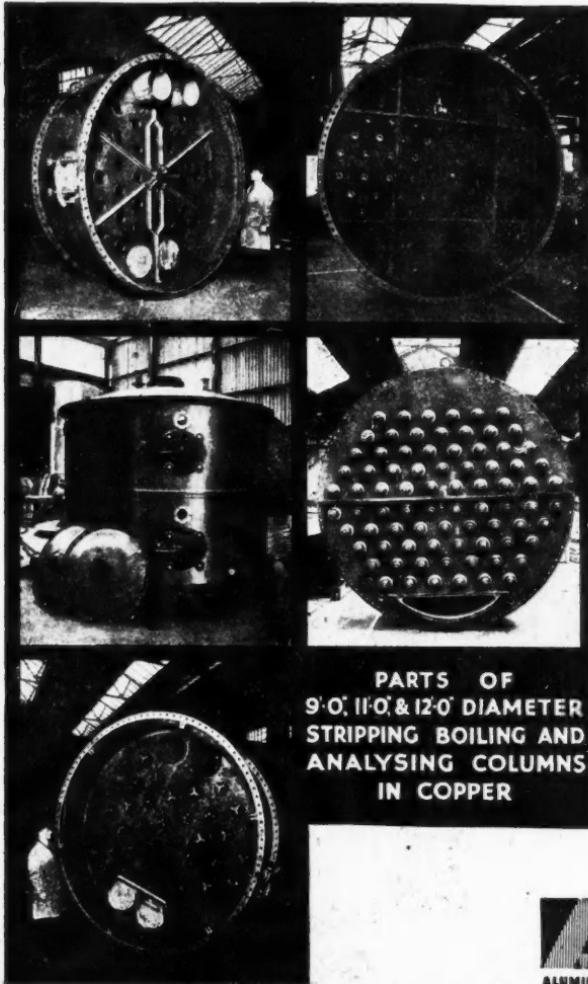
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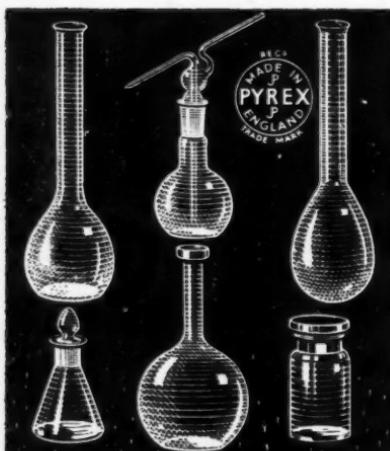
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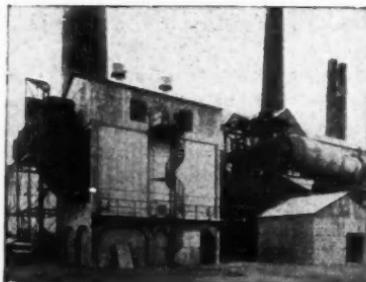
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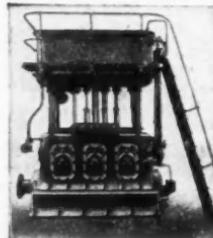


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Needles in a Haystack

In a recent article in this journal a contributor described a neat microchemical device, the Wigglesworth titration apparatus. Intended for estimating the chlorine in the body fluid of single gnats, it was designed by an entomologist for entomological purposes, yet as a microchemical technique it is applicable and valuable in branches of science far removed from the study of insects. Nowadays, the literature of science has expanded to such a degree that there is always the danger that such useful ideas may be lost to view if they are published in a scientific paper slightly off the main track—that track, of rather narrow gauge, consisting of the comparatively few journals which the ordinary working scientist has time to peruse. Before the war no less than 33,000 different scientific periodicals were published throughout the world, quite apart from countless pamphlets and theses of varying degrees of importance. The risks of what Professor Bernal calls "the burying of published work," and its results are very real.

The classic example of a piece of work which was published in an obscure journal and so completely lost that the work had to be done all over again comes from botanical

science. The theory of Mendelism, now so important in plant and animal breeding, was so well buried in the local natural history society's journal at Brno that it had in fact to be rediscovered. In the world of chemistry discoveries are probably less likely to be overlooked; the possibility of commercial exploitation results in a keen examination of the pages of all chemical publications, in a search for any new discovery suggesting practical application. For instance when pelargonidin, the pigment that gives the geranium its vivid scarlet colour, was synthesised in a university laboratory it was not long before a chemical firm had taken out a patent on it—an indication that chemical discoveries stand less chance of remaining in wasteful obscurity than is the case in certain other branches of science.

The problem of extracting the maximum benefit from the already vast and ever growing literature of science is not likely to grow less difficult. It is a problem that affects every scientist yet there is no hope that each individual scientist will be able to solve it in his own way and to his own particular satisfaction. It is often said that every student needs to compile his own text-book out of the notes he takes at

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lectures and from books and papers, in order to get round the inevitable shortcomings of text-books which are almost inevitably out of date by the time they are printed. In the same way most scientists keep some sort of index or filing system for their own reference, so that they can again find a particular paper which they have read. They cannot, however, keep their own check upon papers which they have *not* read, but which may be singularly relevant to their own studies. Therefore, just as no private individual can ever afford to maintain a complete reference library, so the solution of this problem can only be reached on a co-operative basis by some system which has the support of the whole scientific community. The Bureau of Chemical and Physiological Abstracts undoubtedly goes far towards obtaining the collation of new literature which is needed, while the annual reports of the Society of Chemical Industry and of the Chemical Society contribute their valuable quota to the same end, by providing a useful survey of each year's developments. The cost of producing these works—the net cost of the abstracts, for instance, is about £8000 a year—is small in proportion to their value in use.

Still, without in any way belittling what is already being done, we do suggest that there is room for improvement. Abstracts and reviews vary much in quality. We would be the first to admit that the craft of abstracting is not particularly easy, but far too many abstracts fail to fulfil their purpose of summarising the main points in a particular paper or article. Abstracts are useful only so long as they give some idea of the facts that are contained in any given paper. If we consult that paper and finds that it does not contain the facts that its abstract led us to believe were there, then the abstract has failed in its purpose and wasted a considerable amount of our time. Abstracts are needed as a *guide*; they can never serve as a substitute for the whole paper, but they must not be reduced to the point of describing nothing more than what could be deduced from the title of the paper alone.

We have heard sad stories about the working conditions of abstractors which go some way towards explaining why, on occasion, they themselves are "abstracted"—in the absent-minded sense of the word. We know one woman

scientist who was employed as an abstractor of technical literature by a colonial government department. Her salary was £3 a week, and she was told that she had been appointed at this princely figure because she was better qualified—she had a Ph.D. degree—than her fellow abstractors! It seems to us that unless abstractors are better paid than this pin-money scale suggests they often are, they will have to find some means of supplementing their wages. Perhaps it will be necessary to fall back on the amateur system in which abstracting is done purely on a part-time, freelance basis. *Chemistry and Industry* has advocated this method and suggests that abstracting can be done by "competent chemists with a little spare time." This is, however, surely only a makeshift method, and is unduly hard on the trained chemist; for the improvements we should like to see in British abstracting would inevitably involve a large amount of routine work, and it is quite understandable that few scientists would care to give up the thrill of the scientific chase in order to take on these methodical tasks of abstracting and indexing. But just as laboratory assistants are becoming more and more valuable to the world of science, we can foresee the time when a corps of abstractors will constitute a new branch of the scientific profession, which will facilitate, if not augment, the flow of scientific progress. Scientific literature is apt to pile up like timber in a Canadian river, and this new grade of scientific worker could do a great deal in the way of preventing a lumber jam by keeping the logs rolling, by ensuring a constant flow of scientific intelligence.

Keeping abreast of scientific progress to-day demands almost superhuman powers. How often do scientists have to brush aside a proffered novel or excuse themselves for not having read their daily newspaper on the grounds that "they have so much reading to do," meaning, in fact, that the "in" tray on their desk is choked with material that their conscience tells them they must read? It would, indeed, be a work both of utility and of mercy if the business of abstraction and collation could be undertaken on a universal basis. There are specks of pure gold in the indeterminate mass, but the skill of a cunning prospector is needed before they are ready to be put into circulation.

NOTES AND COMMENTS

Salvage and Scientific Periodicals

THE destruction of *useful* literature in the enthusiasm of the paper salvage campaign must not continue. That is the theme of a memorandum entitled "Salvage or Storage?" and issued by the Association of Special Libraries and Information Bureaux. It deals specifically with the periodicals issued by learned societies, professional institutions and research organisations. For the research worker and the scholar it is of prime importance that there should be complete sets of all such publications in a reasonable number of the larger reference libraries. The memorandum states that even the publications of relatively obscure local organisations have proved their value on more than one occasion during the war, while war needs have made it necessary to refer back to the transactions of learned societies as far back as 1669 (though we think that this is rather unlikely to have happened in the scientific world!). When the war ends, demands for such periodicals will come from our own libraries, war-damaged and with depleted stocks, and from European and other countries that have suffered the ravages of enemy occupation in addition to being the scene of actual fighting. Not only will the files for the war years be very imperfect or missing altogether, but there will be many cases where valuable stocks of earlier holdings will have vanished. The stocks from which these demands will have to be met has been reduced by the paper control. ASLIB suggests that learned societies and research organisation should ask their members to retain their copies so that later these can be called in to fill the gaps. Already some societies have made arrangements along these lines, and it is to be hoped that all other scientific organisations will follow suit without delay.

Taxation and Research

IN the course of the debate held recently in the House of Commons on the second reading of the Finance Bill, Mr. Assheton, Financial Secretary to the Treasury, voiced the Government's attitude towards research. His remarks were quite frankly encouraging, and may well be considered admonitory towards

certain sections of industry. Under the existing law, if money is spent on industrial research carried out by a central research body, all the annual contributions made to it by a trading concern are allowed as deductions for taxation purposes, provided that the research body is approved by the D.S.I.R. There are at present some two dozen approved institutions of this kind in the country, but, as Mr. Assheton pointed out, the amendment under debate expressly mentions new developments and new processes, visualising a possible necessary extension of the scope of officially recognised research. Taxation which militates against any such development certainly ought to be reviewed, since, as Mr. Assheton himself remarked, there is no matter on which the future of industry depends more than on industrial research. He said, furthermore, that he would feel much happier if the total amount paid to the approved research associations was very much higher than it is. Nothing is more important than that industry should become research-minded. With such an attitude officially voiced by a high executive of the Treasury, it is evidently the duty of all progressive industrialists, not least the industrial chemists, to use every means in their power to see that the suggested review of taxation is carried through.

Music While You Work

AS announced in the House of Commons last week, an agreement has been made between the Government and the Performing Rights Society by which, for the period of the war, the fees due to composers for the playing of their music in factories will be covered by a composite payment by the Government to the Performing Rights Society. A similar agreement has been made with Phonographic Performance, Ltd., the body which controls the mechanical copyright in gramophone records. From now on factories engaged in war production are relieved from the necessity of obtaining individual licences from the Performing Rights Society for the period of the war, and factories already licensed will be covered by the new agreement from the end of the period for which the last payment was made by them to the Society.

After one year, from May 6, 1943 (the date from which the agreement is effective), either side may terminate it by giving a month's notice. The agreement does not apply to entertainments to which the general public are admitted, nor does it cover performances by living performers unless they are drawn from the workers in the factories themselves. In both these cases individual licences are still required. An impression that a certain amount of acrimony had entered into the discussions leading up to this arrangement may have been left by certain ill-informed letters which have appeared in the Press. Actually, as Mr. Lyttelton announced in the House, both the societies concerned have showed the most helpful and co-operative spirit throughout the negotiations.

Synthetic Food

THE blow, so long threatened, has fallen at last; a completely synthetic meal has been devised, cooked, and actually (we are informed) eaten. Oddly enough, it was not in one of the belligerent countries that this interesting event took place but, according to a Press Association *Times* telegram, at Lausanne on May 26. The chemists responsible for the experiment were hosts at the dinner; they are convinced that they may save Switzerland from famine in the event of the complete stoppage of imports. Furthermore, they state quite definitely that the cost of the meal was a great deal lower than it would have been if the equivalents in natural food had been served, but that the nutritive qualities were the same. This is a quite distinct challenge to the biochemists of our Nutrition Society: we hope that they will take it up and deliver to the world a report of their findings. The dinner was of the "austerity" type—three courses only. The *hors d'oeuvre* was made of chemically treated cellulose, flavoured with coal-tar by-products (flavour not stated). The principal dish was "meat" made from wood pulp, with synthetic gravy. The vegetables, we regret to say, spoilt the record by being really vegetables. The sweet, however, was flavoured with vanillin derived from coal, and the cream was prepared from the same sort of cellulose that supplied the *hors d'oeuvre*. We remember reading a novel some years ago, the title of which was "Sugar from the Air." If

only something on those lines could be developed, an added spice could be given to meals such as the above—though the author of the novel only envisaged a sort of molasses feeding-stuff fit for animals. Meanwhile, some of us may yet prefer to enjoy our feasts in the frugal manner of the Barmecides.

Petrol from Tung Oil

CHINESE chemists, many of them trained abroad, are playing their part in the great task of fortifying Free China. China was short of petroleum, so they developed ways of obtaining lubricating oils from the tung-nut tree. In Chungking the first plant in China to "crack" tung oil and convert it into substitute petrol and Diesel oil has been established. Synthetic petrol, too, is being made in a low-temperature carbonisation plant in Western Szechwan, where bituminous coal of suitable quality is found. The petrol produced in this plant is said to have an octane number high enough to serve aviation needs. When the full story of these war years is told, it will show that China not only resisted the invader, but that she made a substantial start on the road of progress which will bring her from the state of a backward nation to that of a country with modern industries worthy of her culture and courage.

PHYSICAL CHEMISTRY LECTURES

A series of post-graduate lectures on Physical Chemistry, following those on Inorganic and Organic Chemistry delivered during the past two years, is being arranged by the London Section of the Oil and Colour Chemists' Association. This year the lecturer will be Mr. E. J. Bowen, M.A., F.R.S., Fellow of University College, Oxford, and Demonstrator in Chemistry at the University of Oxford. Three lectures in all will be given on Thursdays, July 15, 22, and 29, at 6.30 p.m., in the Physical Chemistry Theatre, Imperial College, South Kensington. The syllabus is as follows: (i) Elementary Wave-Mechanics and Colour of Organic Compounds; (ii) Fluorescence and Phosphorescence; (iii) Theories of Rates of Chemical Change.

An inclusive charge of 10s. for the three lectures will be made to members and their friends, and applications, together with remittances, should be forwarded to Mr. David E. Roe, c/o Atlas Preservative Co., Ltd., Fraser Road, Erith, Kent.

American Scientists at War

Dr. Karl T. Compton's Lecture

THE 1943 Pilgrim Trust Lecture was given in the rooms of the Royal Society by Dr. Karl T. Compton, director of the Massachusetts Institute of Technology. His subject was "The Organisation of American Scientists for the War." After deploreding that the use of science for war purposes should be necessary—a grim reminder that the skill of statesmanship had not kept pace with our ideals—he proceeded to explain in detail the gearing of scientific research to the American war effort. The National Academy of Sciences and the National Research Council were both set up in time of war; the former in 1863 when Lincoln was President, and the other during the Great War, under President Wilson. Under the National Research Council 200 committees are now at work, dealing with such specific subjects as aviation, medicine, passive defence against bombing, and reclamation of

he was second in command of the Paris office that he received a note from Lord Rutherford (then Sir Ernest) to the effect that he would be unable to come to a conference on supersonic submarine detection because he had made some experiments which suggested that he had succeeded in splitting the nucleus of the hydrogen atom. "He added that he would be pleased if I would tell no one about this, in case he was wrong!" said Dr. Compton. Actually, Rutherford had knocked the hydrogen nucleus out of nitrogen, and this note must have been the first record on paper of man's success in transmuting chemical elements. In this war new "temporary" organisations included the *National Register of Scientific and Specialised Personnel*, set up in July, 1940. This central office keeps a register of the nation's scientific and professional skill, on which are 600,000 names,

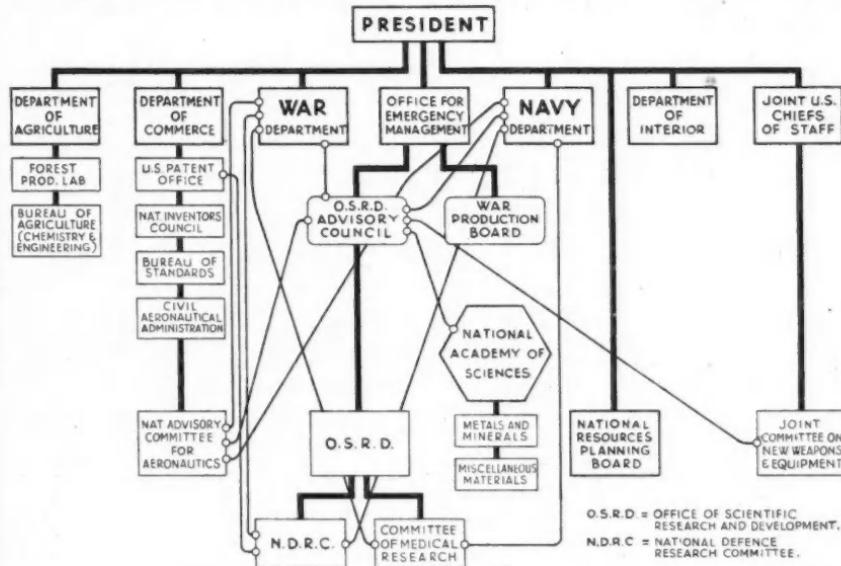


Chart showing organisation of American science.

tin. In times of emergency it appears advisable to set up new organisations for mobilising scientific manpower. In the last war he himself was connected with the Research Information Service, which had offices attached to the American embassies in London, Paris and Rome. It was while

including 71,500 chemists. In all 140,000 names have been certified by it to agencies engaged in the war effort. Organised in June, 1941, the *Office of Scientific Research and Development* fulfils executive functions under the direction of Dr. Vannevar Bush, president of the Carnegie Institute of

[With acknowledgment to *A. Sc. W.*]

O.S.R.D. = OFFICE OF SCIENTIFIC
RESEARCH AND DEVELOPMENT.
N.D.R.C. = NATIONAL DEFENCE
RESEARCH COMMITTEE.

Washington. *The National Defence Research Committee* was set up in 1940, and another new agency was the *Committee of Medical Research*. There was a liaison service between London and Washington, as well as with Canada, Australia and New Zealand. O.S.R.D. research was done through contracts given to scientific institutions, both academic and industrial, the cost being £100,000,000 a year; 1400 contracts had been put out, and some 6000 scientists and engineers were engaged under these contracts. The N.D.R.C. had 19 divisions, which in turn were sub-divided, to deal with particular items like fire control and explosives, while the divisions of chemistry and physics were in the nature of "hold-alls," covering subjects which could not be more specifically classified. One of the latest committees to be formed was the *Joint Committee on New Weapons and Equipment*, with Dr. Vannevar Bush as chairman and the Assistant Chiefs of Staff of the Army and Navy as members. The war had brought a deluge of inventions and ideas from all kinds of people, and the *National Inventors' Council* was set up to sift and refer them, when necessary, to appropriate departments. Out of about 100,000 ideas sent to the Inventors' Council only one was really new or significant. A new department had been set up

to deal with production methods and substitute materials. Dr. Compton also described a scheme whereby technical officers in the armed forces are trained by one-to-four-year courses at a university; some 250,000 men are going through such courses this year.

Compensation for War's Ravages

Dr. Compton concluded by saying that all concerned with the war effort were aware of some significant new applications of scientific research in the war. For most of them the knowledge was largely restricted to the special fields in which they themselves had worked, and of necessity the general public knew only in a vague way about some of these things and nothing at all about most of them. When victory had been won and the whole story of these scientific accomplishments could be told it would indeed be a thrillingly interesting recital. Out of it would come not only its important contribution to victory, but a number of significant results of permanent peace-time value. It was already evident that many of these war-time applications can contribute to our standards of living, general prosperity and comfort, and can help to compensate for the ravages wrought by the war.

Analysing Plant Leaves A Method of Determining Fertiliser Requirements

THREE American scientists, Walter Thomas, Warren B. Mack and Robert H. Cotton, of the Pennsylvania Agricultural Experiment Station, have investigated the possibility of using chemical analyses of leaves to measure the fertiliser requirements of crops. Their experiments, performed with wheat, are recorded in *The American Fertiliser* (1943, 98, 4, p. 5). They approach their problem by finding out how fertilisers affect the nutrition of the plant, for diagnosis by means of analysis of the whole plant is in general not practicable. The possibility of employing the data obtained by chemical analysis of leaf material as a means of revealing the nutrient requirements of crops has repeatedly attracted the attention of physiologists since as early as 1870, but the methods used failed for a number of reasons to provide a satisfactory index of nutrient relationships. The composition of a leaf depends on its physiological age, so that if the leaf is to be made the basis for diagnosis one cannot compare the gross analysis of leaves of all ages, but only leaves of the same age from all plants in the experiment must be taken for analysis. The standard leaf chosen for analysis in these latest experi-

mements was the third leaf up from the base of the plant.

The results of the experiments are shown in Table I. Wheat was grown on four plots, all of which received the same (absolute) quantities of phosphoric acid and potash as superphosphate and chloride respectively. The nitrogen supply was, however, varied both in quantity and quality. Plot A received three times the unit amount of nitrogen, as sodium nitrate; Plot B, the unit amount of nitrogen as sodium nitrate; Plot C, the unit amount of nitrogen as dried blood; and Plot D received no nitrogen, only superphosphate and potash. Columns 3, 4 and 5 give the percentages of N, P₂O₅, and K respectively in the standard leaf (third from base). The last column shows the yields of grain in lb. per plot. Plot A, receiving three times the unit amount of nitrogen, gives the highest yield of grain. It is also seen that there is a three-fold relationship between the nitrogen in the fertiliser, the nitrogen content of the leaf, and the yield of grain. The relationship between the percentages of P₂O₅ and K respectively in the leaf and the fertiliser on the one hand, and the yields on the other, is less evident.

TABLE I

Treatment	Plot	N %	P ₂ O ₅ %	K ₂ O %	Inten- sity factor	Composition of NPK-unit N : P ₂ O ₅ : K ₂ O (quality factor)	Grain yield lbs. per plot
(3N) Na PK	A	3.037	+ 0.521	+ 3.173 = 6.731		70.51 : 7.32 : 22.17	723
N _{Na} PK	B	2.860	+ 0.509	+ 3.178 = 6.547		69.57 : 7.58 : 22.84	705
N _B PK	C	2.662	+ 0.520	+ 3.328 = 6.510		67.75 : 7.73 : 24.51	520
I'K	D	2.340	+ 0.468	+ 3.154 = 5.962		65.48 : 7.95 : 26.57	497

N_{Na} and N_B indicate that nitrogen was applied as sodium nitrate and dried blood respectively.

Thus far we have considered the effect factor of the fertiliser elements separately in their influence on yields. We know, however, from field experience that each element influences the action of the others. And this influence or effect factor can be expressed in precise terms. It is, therefore, necessary to consider these three major fertiliser elements together as an entity. Returning to Table I, the fifth column shows the sum of the percentages of nitrogen, phosphoric acid and potash in the leaf at the moment of sampling, denoting the intensity of nutrition resulting from the particular fertiliser treatments. It will be observed that the intensities increase progressively with increase in yield. A relationship exists, therefore, between these values and the yields. The quantity factor, however, cannot be used solely as an index of the effectiveness of a fertiliser. We need an additional measure that will indicate the quality of nutrition; i.e., an expression that will show the relations of nitrogen, phosphoric acid and potash in the leaf to one another. This magnitude can be obtained by finding out the proportion which each element contributes to the total amount present.

The quality factor of nutrition, therefore, is represented as the proportion which each contributes to a unit amount of all three. But since we are considering the chemical reactions in the leaf at the moment of sampling, it is not scientific to express the quality factor in terms of percentage values. Chemical reactions occur between values known as "chemical equivalent values." When the percentage values in the highest-yielding plot are converted into milligram equivalent numbers, they become:

$$\begin{aligned} N &: P_2O_5 : K_2O \\ 0.7051 &+ 0.0732 + 0.2217 = 1 \end{aligned}$$

To avoid fractions, these values composing the "NPK-unit," are multiplied by 100, and are as shown for Plot A in column 6. The NPK-unit represents the equilibrium (or balance) between the fertiliser elements in the leaf chosen at the moment of sampling. These NPK-units are seen to possess characteristics not inherent in the percentage quantities. The values for phosphoric acid and potash in the leaves from the respective plots are no longer irregular. Now, both decrease progressively as yields increase. Since nitrogen increases progressively with increase in yield, the increase in the nitrogen of the NPK-unit is made at the expense both

of the phosphoric acid and potash. The use of the concepts of the quantity and quality factors in nutrition can now be formulated in the statement, established experimentally, that a fertiliser intervenes in the nutrition of a plant so as to affect a change in (1) the intensity of nutrition or (2) in the composition of the NPK-unit or in both (1) and (2) simultaneously. In interpreting results, therefore, both factors are to be considered.

It is much simpler to show the relation between the NPK-unit values by means of a figure. The relation between any three variables is easily presented on an equilateral triangle. If each side is taken to represent 100 in terms of the unit selected, the sum of the perpendiculars drawn from any point inside the triangle to the three sides will always be equal to 100, wherever this point is chosen in the triangle. Fig. 1 shows such a triangle. In order that we may use a

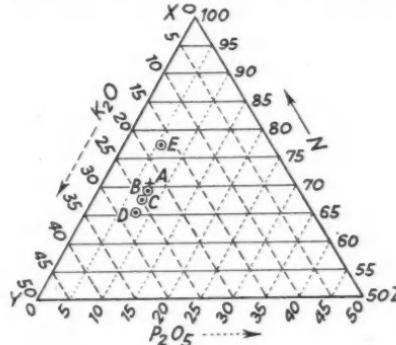


Fig. 1.

larger scale only the upper half of the triangle is drawn. The apex X represents 100 units of nitrogen, the apex Y, 100 units of potash, and the apex Z, 100 units of phosphoric acid. As a point moves up towards X, therefore, the proportion of nitrogen in the NPK-unit progressively increases until at X it becomes 100 per cent. Similarly, as a point moves towards the apex Y the proportion of potash increases, and as a point moves away towards Z the phosphoric acid increases. The locus of the NPK-unit of the highest yielding of the plots we are considering, namely, Plot A, is marked by a cross and the loci of the other treatments are

indicated by dots. It is to be noted that the locus of Plot B, the second highest yielding plot is quite near that of the optimum Plot A, and is nearer than any of the others. It is also to be observed that the much greater difference in yields between Plots A and B, on the one hand, and Plots C and D on the other, is reflected in the figure by the increasing remoteness of the loci of the latter from that of the optimum.

We could amplify this illustration by many more examples from our experiments. Thus, in the figure the locus of the NPK-unit for Plot E, which received the unit amount of nitrogen in the form of dried blood without phosphoric acid or potash, is shown (also). The yield of this plot is very low (266 lb.). Associated with this low yield is a low intensity (4.67) and a position of the locus of the NPK-unit far removed from the optimum, resulting from too high a value for nitrogen in relation to phosphoric acid and potash. The leaf analysis of this plot gives a percentage of nitrogen in the leaf of 2.540, a value which is in between that for Plots C and D. But the yield of Plot E (N) is only 266 lb. compared with 497 lb. from Plot D. The percentage content of nitrogen in Plot E, therefore, does not supply the answer to the low yield. An explanation, however, is furnished by the NPK-unit values, for we see that the locus of the unit of this plot, Plot E, is far removed from the locus of the optimum; nitrogen is too high relative to phosphoric acid and potash.

TABLE II

Plot	N	P ₂ O ₅	K ₂ O	Intensity
E	2.540	0.312	1.821	4.673
Composition of the NPK-unit				Yield of
N : P ₂ O ₅ : K ₂ O				grain (lb.)
77.61 : 5.78 : 16.61				266

The experimental facts show that any treatment that will cause the locus of a point to approach that of the optimum will cause the yields to approach that of the equilibrium.

Of course, this optimum is not a fixed constant because the NPK nutrition resulting from a particular fertiliser applied to a given species is not a definite absolute every year, for the NPK nutrition depends on other factors which vary with the year or season. By carrying out the experiments over a sufficient number of years, the limits of the changes in the NPK nutrition of a given species, in a particular soil, in a particular year, the method of leaf analysis outlined supplies information of a precise nature by indicating the nature of the lack of balance between the fertiliser elements.

The procedure of diagnosis by means of the relatively simple method of collecting a few leaves places in the hands of the investigator a valuable tool that enables him through a knowledge of the nutrition of his plants to secure more information than can be obtained in any other way.

Parliamentary Topics

Nigerian Copper

In the House of Commons recently Mr. Creech Jones asked the Secretary of State for the Colonies whether, in respect of the grant of £750,000 made to the Nchanga Consolidated Copper Mines to increase copper production in Northern Nigeria, this development would employ more Africans; whether conditions would be attached to such grant and employment with respect to family accommodation and some proportion of permanent settlement with reasonable amenities; and whether conditions would be imposed preventing colour-bar practices and the adoption of the recommendations of the Commission into the Copperbelt disturbances.

The Secretary of State for the Colonies (Colonel Oliver Stanley): The Ministry of Supply is making a grant of 50 per cent. of the cost of certain capital expenditure at the Nchanga copper mine for the purpose of obtaining an increase in output. Within that expenditure a sum of £135,000 is provided for the building of a township and native housing. There is no information here as to the exact items upon which the £135,000 will be spent. The Ministry of Supply contract does not include provisions dealing with the matters referred to in the second and third parts of the question.

Mr. Creech Jones: May I ask the right hon. and gallant Gentleman whether, when this grant is actually made, conditions with regard to the welfare of the African workers can be embodied in it, particularly in regard to work of a superior character, so that the colour bar does not operate, and, further, that certain wage standards should be established and general welfare provisions made with regard to the conditions of employment?

Colonel Stanley replied that the grant was made for the express purpose of increasing copper output during the war, and that must be the primary consideration.

Nigerian Tin Mines

Mr. David Adams asked the Secretary of State for the Colonies whether he was satisfied with the rations provided for conscripted labour on the Northern Nigerian tin mines and with the arrangements to safeguard these workers' health.

Colonel Stanley said that while the latest reports received showed that there was still room for improvement, conditions in the minefield continued to get better. He was satisfied that the Nigerian Government were doing all they could, despite the inevitable difficulties created by the war, to safeguard the health of the workers. They were waiting for the completion of the necessary building to appoint extra medical staff.

Sodium Sulphate for India

Simple New Extraction Process

THE discovery of a source of sodium sulphate at Didwana, a salt deposit about 40 miles north-west of Sambhar, in Jodhpur State, India, is described in an article by Mr. H. B. Dunncliff, Chief Chemist, Central Revenues, in *Current Science* (January, 1943). He states that much research has been carried out during recent years concerning the manufacture of edible salt from subterranean brine at Didwana, and it has been found to contain a considerable percentage of sodium sulphate, which, if extracted, could be of great service to the tanning industry. As a result of experiments by Mr. J. M. Saha, Chemical Examiner, Central Excises and Salt, North-Western India, it is now possible to put on the market a better quality salt than hitherto, and the manufacturing season can be extended, resulting in higher production, and relieving local unemployment. Didwana can now also increase in importance as a source of alimentary salt, while a valuable and much wanted industrial by-product can be obtained in sufficient quantities to satisfy the whole of India. The sodium sulphate is principally derived from the "rohr" or pan-bed crust, a percentage of 97.5 to 98 being regularly found.

A Seasonal Change

Taking advantage of the fact that the solubility of sodium sulphate falls sharply with the temperature of the brine, while that of the chloride is little affected, Saha remarked that during the cool weather of November-February the sulphate in the pan-beds had crystallised out as the decahydrate, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$, losing water during a rise in temperature at a later stage. He therefore suggested that while the salt manufacturing season proper would begin, as customary, with the warm spring weather, the sulphate manufacturing season should start in November, a certain number of pans being set aside at night for the elimination of the sulphate. When the maximum amount of sulphate had separated, the purified brine should be transferred in the early morning to a separate set of crystallising pans, where it would be evaporated by the daytime heat for the manufacture of salt.

Actual experiments proved that the temperature of the hot brine never fell to the low atmospheric temperatures expected, owing to the heat of the ground, but results on the whole were most satisfactory, and the process has proved to be one that can be operated even by the illiterate local *desuals* (salt manufacturers). Furthermore, the quality and appearance of the salt produced are greatly enhanced by the almost complete removal of the principal impurity

—sodium sulphate—which is reduced by the Saha process from 9.45-12.79 per cent. to 0.85-1.40 per cent.

China's Mineral Output

Tungsten Production

THE Chinese Ministry of Economic Affairs has, since 1937, endeavoured to carry out ambitious plans for the development of Free China's mineral resources. Gold, iron, copper, lead, zinc, silver, tungsten, mercury, antimony, and tin are all produced in Western China, as is coal also. Coal production in 1940 reached a value of 114,000,000 yuan, while the output of iron ore exceeded 300,000 tons. Improvement work was undertaken in 1940 to better native methods of mining copper, and a silver refinery was established on the border between Szechuan and Yunnan. In Kweichow Province a three-year exploitation programme was inaugurated to raise the production of mercury and cinnabar to 100 tons and 20 tons, respectively, by 1942. New gold deposits have been uncovered in Sinkiang and Sikiang Provinces, and new lodes have been reported in Yunnan.

China has been for many years the world's chief producer of tungsten, supplying 60 to 70 per cent. yearly of world production. Naturally, the war has greatly stimulated demand for this metal, which is an essential element in the strong metal alloys vital to heavy industry. The richest tungsten ores in China are found in Kiangsi Province, and the importance of tungsten to war industries has impelled the Government to make tungsten mining a State monopoly.

Labour Limits Tin

In the Kochiu district Yunnan Province boasts the richest deposits of tin ore in China; but while the National Resources Commission has advanced capital to the owners of the small independent smelters—who are said to control 80 per cent. of the Kochiu output—the tin industry suffered in recent months from a shortage of labour as well as from the failure in delivery of a large consignment of mining equipment which had been ordered from the United States. Yunnan's tin production in 1940 was about 8000 metric tons, the great bulk of which was shipped to the United States and other Western countries. Since the war, however, production has been curtailed, while the lack of transport has severely reduced exports.

During 1941 Free China produced, as part of its potential contribution to the war effort of the United Nations, 11,500 tons of tungsten, 7600 tons of antimony, 7000 tons of tin, and 120 tons of mercury, and only the lack of transport interfered with even greater contributions.

Personal Notes

DR. R. TRAILL, Ph.D., has been appointed Deputy-Director of the Scientific Liaison Bureau in Melbourne, Australia.

MR. DAVID M. PAUL, a well-known member of the Manchester Section of the Society of Chemical Industry, has retired after 27 years' service as departmental manager with the Clayton Aniline Company, Manchester.

MR. L. P. O'BRIEN, F.C.I.S., has been elected chairman of B. Laporte, Ltd., in place of **MR. HARRY ARNOLD**, who has voluntarily relinquished the office which he has held for fifteen years. Mr. Arnold retains his position as a director of the company.

SIR WALROND SINCLAIR has accepted the chairmanship of United Glass Bottle Manufacturers until the end of the present financial year. **MR. T. C. MOORSHEAD** and **MR. H. J. JUDD** have been appointed joint managing directors.

The Victoria Cross has been awarded to **WING-COMMANDER G. P. GIBSON**, D.S.O., D.F.C., for his gallant exploit in bombing the German dams. As stated last week, Wing-Commander Gibson is the son of **MR. A. J. Gibson**, of the London Shellac Research Bureau.

DR. A. STANLEY COOK, head of the research and biological laboratories of Ayerst, McKenna and Harrison, Ltd., and a director of the firm, was elected chairman of the Montreal Section of the Society of Chemical Industry at its annual meeting, in succession to Professor W. D. McFarlane.

Owing to indifferent health, **SIR JOHN T. CARGILL** is resigning from the boards of the Burmah Oil Company, the Anglo-Iranian Oil Company, and other companies with which he was associated. Sir John is succeeded in the chairmanship of Burmah Oil by **MR. R. I. WATSON**, the present managing director.

At the recent meeting of the American Chemical Society in Detroit, **MR. EARLE O. WHITTIER**, a senior chemist in the research laboratories of the Bureau of Dairy Industry, U.S. Department of Agriculture, was presented with the \$1000 Borden award for research in milk chemistry. The Eli Lilly award in biochemistry went to **MR. HERBERT E. CARTER**, a member of the staff of the biochemistry department of Illinois University. **MR. J. F. SCHAIER**, for 17 years chief chemist of the National Bureau of Standards, received the 1943 Hillebrand prize for his work on multi-component silicate systems. The Jacob F. Schoellkopf medallist for 1943 is **MR. R. R. RIDGWAY**, an expert on electrothermics who has improved the industrial techniques for producing fused alumina, silicon carbide, and magnesium. Mr. Ridgway, who is associate

director of research of the Norton Company, Niagara Falls, is the discoverer of boron carbide, the next hardest material to the diamond.

Birthday Honours

Among the awards made in the Birthday Honours List published on Wednesday the following are of special interest to the chemical, metallurgical and allied industries: **MR. GEOFFREY LLOYD**, M.P., Parliamentary Secretary (Petroleum), Ministry of Fuel, and Chairman of the Oil Control Board, becomes a Privy Councillor; **MR. HERBERT DAVIS**, Director of Oils and Fats, Ministry of Food, receives a Knighthood, as do two leading figures in the steel industry: **MR. JOHN CRAIG**, chairman and managing director of Colvilles, and **MR. ARCHIBALD MCKINSTRY**, deputy-chairman and managing director of Babcock & Wilcox. **PROFESSOR GEORGE PAGET THOMSON**, Professor of Physics at Imperial College, is another new Knight Bachelor.

The C.B.E. is awarded to **DR. E. S. GRUMELL**, chairman, Fuel Efficiency Committee; to **MR. J. S. HOLLINGS**, chairman, Anti-Glare Advisory Committee, Iron and Steel Federation; and to **DR. J. N. MUKHERJEE**, Professor of Chemistry, Calcutta University. **COLONEL P. J. G. GUETERROCK**, vice-president, Institute of Metals, becomes a C.B. (for services to the T.A. and A.F. Association); and the M.B.E. is awarded to **MR. R. C. ARBERY**, Inspector of Metallurgy, India.

Obituary

MR. E. J. HALLMARK, who retired at the end of last year after serving as Midland representative of Stewarts and Lloyds for 30 years, has died at Callow End, near Worcester.

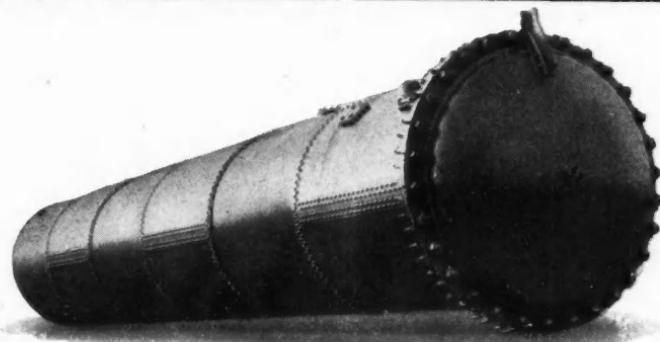
MR. WILLIAM ARTHUR HARRISON NAYLOR, F.C.S., F.I.C., who died at Beeston, Nottingham, on May 30, aged 89, was a director of The British Drug Houses, Ltd., from 1908 to 1921, when he retired from the board. He was especially well known in pharmaceutical circles, and had been president of the British Pharmaceutical Conference. His fellowship of the Royal Institute of Chemistry dated from 1887, and of the Chemical Society from 1878.

MR. JAMES ARTHUR HILL, who died on May 25 at Runcorn, Cheshire, aged 62, was well known as an industrial chemist on Merseyside. He was manager of Hazlehurst's Soap Works, Runcorn, a concern which was absorbed by Lever Brothers some years ago and transferred to Port Sunlight. Mr. Hill, however, continued to reside at Runcorn, and he remained working at Port Sunlight until the week-end before his death.

Metallurgical Section

Published the first Saturday in the month

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Metallurgical Section

June 5, 1943

Secondary Tin and Lead*

The Metallurgy of Refining

THE peculiar and changing conditions of a war-time market, coupled with the necessary restrictions, have resulted in an accumulation of a large amount of certain secondary metals in the tin-lead alloy class. It has even been proposed in America that Government agencies should finance the creation of stock-piles of these secondaries.

It is obvious that the more nearly a secondary metal corresponds in composition to a commercial formula and the lower its content of impurities, the easier it will be to restore it to some commercial quality. Because of this very simplicity, however, the margins on purchases of any such metal will be small. Good margins are found mainly in impure metals and drosses, those which require much refining or processing of a special kind. This market condition makes it highly desirable to remove each separate individual metal of an alloy preferentially, and the more perfect this selective removal of the undesired constituents can be made, the less by-product there will be and, therefore, the greater the probability of commercial success. This is a constant challenge to the laboratory.

The Parkes Process

A good illustration of a process which is perfect from this angle is the removal of zinc from lead in the Parkes Process. By means of chlorine and the Betterton apparatus,¹ under proper control, chlorine removes only zinc and produces zinc chloride of commercial quality. In general, refining operations fall into two classes—those in which a reagent metal is added to form intermetallic compounds or similar high-melting-point phases, and those in which other chemical reactions take place not involving an added reagent metal.

The classic example of the first class is the Parkes Process, whereby a reagent metal, zinc, is added to silver-bearing lead so that, on cooling, a silver-zinc crust freezes out which is then handled in the well-known manner. For a great many years it was believed that an actual silver-zinc compound, Ag_2Zn_3 , was formed and the formula agreed with actual experience. More recent work

shows that what was thought to be a compound is really a solid solution. From the refining standpoint, however, this explanation makes no changes in operation; for the refiner it does not matter whether he is dealing with an intermetallic compound or not, so long as a new metal phase with high melting-point and low solubility at low temperatures has been created. Such a phase will crystallize out as a crust and, as such, can be moved from the main body of molten metal, thus refining it.

Selective Reagents

The other class of refining operation, involving chemical reactions, depends for its usefulness on selective action of the reagent on the metals higher in the electromotive series than lead. For the purpose of chemical metallurgy, it is more useful to arrange the metals in the order of the heats of reaction of their oxides with the reagent in question, as long as it is kept in mind that temperature and concentration of reactants and other factors may change the order somewhat. An alloy of zinc, tin, antimony and lead, exposed to air oxidation at red heat shows that the zinc will be oxidized first, then the tin, then the antimony, and finally the lead, although there will be a considerable overlap. A table of heats of formation of oxides of some metals² will further illustrate this point. The values are calculated for room temperature in K/cals per mole and for one atom of oxygen, so that they are directly comparable:

CaO	151.7	Sb ₂ O ₃	55.1
MgO	146.1	PbO	52.46
Al ₂ O ₃	126.6	As ₂ O ₃	51.36
Na ₂ O	99.45	Bi ₂ O ₃	45.7
ZnO	83.5	Cu ₂ O	42.5
SnO ₂	69.05	TeO ₂	38.8
SnO	67.7	CuO	35.5
CdO	65.2	PbO ₂	32.5
FeO	64.3	Ag ₂ O	6.95
NiO	58.4	Au ₂ O ₃	-3.66

Sodium and aluminium remaining as residues in metals after using them as refining reagents can be removed by oxidation, steam, or by the mixed-metal man's inseparable companions, sulphur and sal ammoniac. The choice of the process or reagent for use in the removal of a certain metal is largely deter-

* From an address delivered by Gustave E. Behr at the A.I.M.E. annual meeting, February 18, 1943.

mined by the composition of the metal mixture which is to be refined. For instance, if the antimonial lead from the smelting of battery plates is to be converted to soft lead, the tin and antimony can best be removed by oxidation at fairly low red heat. Expensive reagent metals, such as sodium or aluminium, would not be employed for antimony removal unless an important percentage of tin were present which had to be retained. When scrap metal has been melted down there is likely to be some dirt floating on it, but even after this dirt has been skimmed off, a dirty metal still remains. Dry drossing is necessary to make a good separation of dirt and oxides from metal. Different people use different methods for this cleaning. Frequently rosin or sal ammoniac is stirred in and this brings most of the non-metallic material to the surface ready to be skimmed off.

Further cleaning can be carried out by poling. Although this term implies the use of green wood, actually with low melting metals green wood is seldom used. A few scabby potatoes immersed in the metal by means of an iron container act as an excellent substitute. But an organic material is not at all necessary as there is negligible reduction of oxides at low temperatures. An excellent and simple way to "pole" a metal is to blow steam through it, and it is amusing to note that blowing a metal with steam is also called "poling" in Germany. Bubbles of any kind serve to collect dirt and dross in a molten metal in the same way that air bubbles act in flotation. Some metals may be efficiently cleaned by washing them with caustic soda, which removes dirt and oxides chemically.

Decopperising

Specifications for maximum copper content exist for many white metals. Type metals, solders, lead-base bearing metals, battery grid metal, all have a low permissible copper content. Generally, copper removal is necessary with secondary metals of these classes. It is practically a universal custom to carry out this decopperising with yellow sulphur. Sulphur, however, is neither efficient nor economical; one pound of sulphur may remove 2.4 lb. of copper and so produce 20-40 lb. of dross. The result depends mainly on the composition of the metal, as the decopperising procedure is standardised and well known, and need not be described here.

Aluminium, chemically a highly reactive material, can be used effectively for removing iron, arsenic, copper, and antimony from tin, lead, or tin-lead alloys,² and it has a marked preference for these impurity metals in the order given. Since the first three metals are always objectionable when present as impurities in solder, and as antimony frequently needs reducing, the aluminium process has been found to be useful in refining solder alloys. The aluminium refining process can

be described briefly. First, determine the weight of each impurity to be removed from the charge of secondary metal. One pound of aluminium will remove 3-4 lb. of the impurities listed above, the amount depending on the tin content of the charge, as the reaction is more efficient with high tin percentages. Add the required amount of scrap aluminium to the molten metal in a kettle, stirring it in when the temperature has been raised to the point at which aluminium readily melts into the charge.

The kettle is then allowed to cool down, when a mush will crystallise out and float on the surface of the charge. This mush or "thicks" will contain the impurities and aluminium combined in the ratio of 1 to 3 or 4. It is removed from the metal and disposed of as required. Every mixed-metal man has his own particular preference as to the way to handle thicks. Aluminium thicks have a low solubility in lead-tin alloys at temperatures close to their liquidus temperatures, so that a very perfect separation can be made. The refined metal which remains will always be somewhat contaminated with residual aluminium, but this can be removed as already described, giving a refined metal of the highest degree of purity.

Zinc Removal

Zinc is little used in making alloys, but, nevertheless, the secondary alloys frequently contain small quantities of zinc, occasionally amounting to several per cent. Its presence is due to either careless collecting or imperfect sorting of scrap, and the last trace of zinc must be removed in order to obtain a saleable metal. The commonest way of removing zinc is to heat the metal to cherry-red heat and let selective oxidation do the job. From time immemorial zinc has been removed in this way from desilverised lead bullion. With a tin alloy, sal ammoniac, stirred in at red heat, will hasten the selective removal of zinc and so conserve the tin. Chlorine also does a fine selective job, but has the disadvantage of taking a very long time to bubble through a metal in any considerable quantity; special apparatus for chlorine treatment for zinc removal is not justified for secondary metals. Caustic soda is an excellent reagent for removing zinc, but its use cannot be recommended when tin is present in the alloy, unless the tin also is to be removed. Lead chloride is chemically an ideal reagent to use for removing zinc, aluminium, sodium, or any other metal higher in the chloride series of heats of formation than lead.³

Arsenic Removal

Arsenic is not found in secondary metals to any great extent; nevertheless, it does crop up at most inconvenient times and plans for its removal must be prepared. Probably the oldest method is to oxidise it out. When an

arsenical metal is heated red hot, arsenic fumes are given off. Arsenic when present in alloys is oxidised before the antimony, but after the tin, and so it is not practical to use air oxidation for arsenic removal from tin alloys. A well-founded procedure is to use zinc for removing arsenic from tin alloys. The metallurgical process used in England is as follows: stir in finely divided zinc at 450° C., allowing 1 lb. of zinc to 1.7 lb. arsenic. Cool to 250° C. and skim off the thicks. The thicks are treated in a sweating furnace, yielding metal and dry dross. The metal is then returned for re-treatment. A second treatment of the main metal product may also be necessary if the arsenic has to be reduced to 0.01 per cent., or less. Another process for arsenic removal uses aluminium. In the presence of tin and antimony, aluminium is not as selective as could be desired, because of the possible danger arising from the aluminium-arsenic by-product. In contact with water, the aluminium may generate hydrogen gas, and highly toxic arsine gas may be produced if the nascent hydrogen meets the arsenical material. Suitable precautions need to be taken to prevent such an occurrence.

Tin Removal

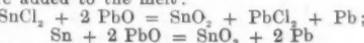
Tin is always a most important metal from the economic standpoint. Its high price ensures that tin metals will be salvaged and, to-day, everybody has been made "tin-conscious," since its value in use is far greater than its price. Important tin-conservation measures have already been taken, one of which provides for the purchase of secondary electrolyte metal for tin removal as sodium stannate or for recovery as electrolytic tin. As a result a particular process has taken on greater importance than would be its normal lot.⁴ Secondary hard lead containing tin can often be bought at a price that makes tin removal worth while, leaving antimonial lead as the metal product. Molten caustic soda plus an oxidising agent reacts with tin in molten tin-lead alloy to form sodium stannate. Unfortunately, in most cases, a considerable amount of antimony will simultaneously be removed as sodium antimonate, so contaminating the stannate. This occurred with the Harris Process which was early found to be successful in this field. The oxidising agent used was sodium nitrate, and on an average one pound of antimony was removed for every 3 lb. of tin, so necessitating a separation of the antimonate and stannate before the latter could be used for making electrolytic tin. Then it was discovered that steam acted as a suitable oxidising agent, if steam, molten caustic, and molten metal were brought into simultaneous contact. The important point of this discovery was the fact that the steam oxidises only the tin and arsenic, and not the antimony or lead, so that quite pure

sodium stannate is produced. The reaction, $\text{Sn} + 2\text{NaOH} + \text{H}_2\text{O} = \text{Na}_2\text{SnO}_3 + 2\text{H}_2$, is the basis of this process. The sodium stannate can be electrolysed in aqueous solution, the tin produced being of Straits quality or better, i.e., at least 99.82 per cent. tin.

Selective Oxidation

Selective oxidation by air may also be mentioned as a means of tin removal. A patent was taken out several years ago⁵ in which this property was utilised to the fullest extent. A kettle full of metal containing tin, antimony, arsenic, silver, and lead was heated to about 600° C., and agitated at very high speed. All the metals present, except silver, were oxidised, but the oxides of antimony, arsenic, and lead were brought into such intimate contact with the molten metal by the violent stirring that they in turn oxidised the tin. The method is explained by the reaction with lead oxide: $2\text{PbO} + \text{Sn} = 2\text{Pb} + \text{SnO}_2$. The net result was the production of drosses containing 30-40 per cent. Sn, which represents an efficient selective oxidation. Antimony formed 10 per cent. or more of the tin content of the dross, and lead was usually present in a greater amount than the tin.

Several other patented processes for removing tin should be mentioned. One of them uses chlorine in the following way.⁶ When an alloy of tin and lead is exposed to the action of chlorine gas, both lead chloride and stannous chloride are formed. The following reversible reaction comes into play, suggesting that an inconclusive equilibrium might be reached: $\text{PbCl}_2 + \text{Sn} \rightleftharpoons \text{SnCl}_2 + \text{Pb}$. This equilibrium is not achieved, however, since by the use of excess chlorine the SnCl_2 is converted to SnCl_4 , which is removed from the system by volatilisation. For this reason, the reaction proceeds from left to right, and the tin is removed from the metal. In other patent processes the metal is treated with lead chloride,⁷ according to the reversible reaction just given, and metallic oxides are added to the melt:



This process is used very successfully on a large scale in London, black slag from the softening of antimonial lead being used as the oxidising agent. The reaction is remarkably rapid. In a 50-ton pot of 6.93 per cent. antimonial lead containing 0.87 per cent. tin, the tin was reduced to 0.05 per cent. at an average rate of 440 lb. tin removed per hour. As frequently happens, the difficult part of the process lies in the recovery of values from the by-product, the spent flux. This is heated in a reverberatory furnace to fume off the lead chloride which is then collected in a bag unit, but this reaction is found to be slow and costly. The tin dross remaining in the furnace at the end contains 44 per cent. Sn and only 0.25 per cent. Sb.

The softening of antimonial lead by oxidising the antimony at low red heat has been practised for generations. Aluminium is an excellent reagent for antimony removal. It is only used, however, if there is tin in the alloy, in order to conserve the tin. In the absence of tin, softening by oxidation would be more satisfactory in every way. Metallic sodium is also widely used as a reagent for antimony removal, the process⁵ having been patented in 1930. One pound of sodium removes about $2\frac{1}{4}$ lb. of antimony. Thicks are formed which rise to the top of the melt. At this point the process has a highly original feature, not found in any other intermetallic process. After cooling down the metal, caustic soda is added, in an amount ten times that of the sodium used. The molten caustic dissolves the antimony-sodium compound and an excellent separation is obtained by simply ladling off the caustic soda melt. When cold, the latter is treated with water which decomposes the sodium compound, yielding an antimony about 90 per cent. pure. When the antimony removal is made from a tinny metal—solder stock, for instance—the caustic skims are not treated with water, as that involves a loss of chemically-combined tin, but are smelted for recovery of values contained.

Lead and Iron Removal

When tin-based babbitt comes back into the secondary metal market it has a certain amount of lead mixed with it, due principally to careless collecting of the scrap. To be described as "high grade" it must contain 70 per cent. or more of tin. Lead may vary from one to ten per cent. To be suitable for re-conversion to tin-base babbitt the lead must be reduced so that the finished metal contains not more than 0.35 per cent. Pb. Some refiners effect this lead removal by means of chlorine gas, which proceeds according to the lead-chloride/stannous-chloride reaction already discussed in connection with tin removal.

Sulphur removes iron from tinny metal by an operation exactly similar to decopperising. Iron makes a tinny metal sluggish, the iron-tin compound, FeSn_2 , being responsible for this quality; and the simplest procedure is to add sulphur until the sluggishness has been eliminated. Any iron that remains will do no harm. The use of sulphur, however, is to be avoided whenever possible, as it produces a relatively large amount of dross. As already stated, aluminium removes iron from tin and its alloys. Perfect iron removal is obtained and this is accompanied by removal of arsenic and copper, which is usually also desirable.

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"Permitted" Steels

Memorandum for Ferro-Alloy Users

THE British Standards Institution has issued, for the Ministry of Supply, the memorandum B.S. 970B (superseding 970A), detailing the restrictions imposed on the use of alloy steels with a view to the conservation of alloys. Restricted steels, in accordance with Direction No. 2 of the Iron and Steel Controller, are those which contain .40 per cent. or more of chromium or of nickel; .10 per cent. or more of molybdenum, tungsten, or vanadium; 10.0 per cent. or more of manganese.

Three tables are incorporated in the memorandum. Table 1 shows the "permitted" alloy steels, with their applications, where restricted. Table 2 (to be used in conjunction with Table 1) is a reprint of Table 2 in B.S. Schedule 970/1942, with the addition of the new specification En 100. It includes steels for hardening and tempering and the mechanical properties specified are obtainable within the limit of ruling section named. Table 3 shows the only permitted steels for case-hardening. In both Tables 2 and 3 certain non-alloy steels (use of which is not controlled by the Direction) are included for reference. For certain special purposes the Steel Controller is prepared to issue a sanction for manufacture of restricted steels if the ferro-alloy position permits, but all concerned must satisfy themselves that no "permitted" steel is suitable before applying for a sanction. The memorandum gives details of the method of applying, and of certain steels and purposes which are not affected by the Direction. Copies of the memorandum (B.S. 970B) may be obtained from the B.S.I., 28 Victoria Street, S.W.1 (price 6d. each; 3 or more copies, 3d. each).

Brazil's production of manganese ore this year is expected to reach 400,000 tons, most of which will be exported to Allied countries. Brazilian chrome production is also reported to be on a much larger scale this year in consequence of increased U.S. demand for this mineral.

Electrometallurgy*

Recent Advances in the Industry

DURING recent years, and especially since the outbreak of war, development in the electrometallurgical field has proceeded with astonishing rapidity. This development has been particularly pronounced in the United States where raw materials are plentiful and there are ample facilities for the production of cheap electrical energy. The possibilities of further expansion both in this country and elsewhere, however, are now being exploited, and the development of the home industry will doubtless be stimulated by the growing realisation that, in certain circumstances, electrical energy can be produced by the modern steam generation station on a basis which compares favourably with the cost of production by hydro-electric plant.

Two Types of Process

Electrometallurgy may conveniently be subdivided into two main sections covering electrolytic processes and electrothermal processes respectively. The former include extraction, refining, electrodeposition, surface protection, and so on. In the extraction field mention may be made of the enormous expansion in the production of aluminium and magnesium, and of the excellent pioneer work now yielding results in America on the electrolytic production of manganese from low-grade ores.

Turning to the sphere of electrodeposition, bright plating, which was first introduced some years ago, has since made great strides. This is particularly noticeable in the case of nickel and latterly also of zinc. Electrogalvanising has to a large extent superseded the old hot-dip process, while considerable progress is being made in the corresponding electrotinning industry. Hard chromium plate is in wide demand throughout the engineering industry as means of obtaining improved resistance to surface wear and abrasion of metals and alloys. The persevering efforts which continue to be made to find a non-toxic substitute for plating baths of the cyanide type appear to be meeting with some success, more especially as regards the deposition of copper. Recent work on the deposition of aluminium from non-aqueous electrolytes is of outstanding interest and has led to the development of a process which is now being exploited on a semi-industrial scale. Considerable advances have also been recorded in the deposition of alloys, a field which for certain engineering and other applications would appear to offer attractive possibilities. Until a few years ago, electrolytic polishing was almost unknown out-

side the laboratory. It is, therefore, interesting to record the rapid progress made recently in the industrial development of this method of surface finishing.

In the electrothermal field the most noteworthy achievement of recent years has probably been the perfecting of the coreless induction furnace; originally such furnaces were used mainly for melting and alloying, but promising results have also been obtained by using them in refining practice. The use of the coreless furnace as a means of raising the temperature of metals and alloys for purposes of heat treatment is becoming increasingly popular; the versatility of the method is well illustrated by its application to the internal hardening of hollow parts. In the resistance-furnace field developments have largely been confined to improvements in the design and control of units of the closed type intended to be used with special gas atmospheres. Arc furnaces have undergone marked changes in design, but apart from the growing demand for electric steel and consequent expansion of plant there has not been a great deal of change in arc-furnace practice during recent years.

VOLUMETRIC DETERMINATION OF COPPER

At a meeting of the Society of Public Analysts this month (May 5) C. C. Oglethorpe, B.Sc., and C. G. Smith, B.Sc., Ph.D., F.I.C., presented a paper on the volumetric determination of copper by the iodine thiocyanate method.

The standard methods for determining copper volumetrically by the liberation of iodine in presence of potassium thiocyanate are found to yield low results, especially if the thiocyanate is added before the iodide, owing to decomposition of the cupric thiocyanate as soon as it forms. This difficulty can be overcome without using any considerable quantity of potassium iodide, by first titrating with a small concentration of iodide present and then completing the titration in the presence of a slight excess of ammonium or potassium thiocyanate. The end-point is distinct and the results are accurate and can be reproduced. The presence of small quantities of acid in the copper solution does not affect the results adversely.

Increases of 10 per cent. for copper ore and 5 per cent. for refined copper in respect of sales to the United States have been announced in Santiago by Mr. Graham, representative of the Metals Reserve Co. of the United States, following discussions with Chilean Government representatives.

* Summary of a lecture by Dr. J. W. Cuthbertson, Manchester University, delivered at the Royal Institute of Chemistry on May 19.

Heat-Treatment of Alloys

Wrought Aluminium Problems : Association Bulletin

THE third of a series of information bulletins by the Wrought Light Alloys Development Association, to assist users of aluminium alloys in overcoming production problems, has been published. It is intended primarily for the non-technical personnel in works, but a brief explanation of the fundamental principles of heat-treatment of the aluminium-base alloys is included as an appendix. The bulletin deals essentially with the practice of heat-treatment and describes the necessary operations of heating and cooling the wrought aluminium alloys under strict control, in order to obtain the required properties. The term heat-treatment may be taken to include all operations in which changes in temperature result in a change in the properties of an alloy, but it is usually confined to the operations known as solution-treatment (or less correctly, "normalising") and precipitation-treatment (or "artificial aging"). These processes strengthen the metal but annealing causes softening. Notes on the groups of alloys include tables giving typical mechanical properties of some representative alloys in the annealed and work-hardened conditions, and the strength requirements of some typical heat-treated alloys taken from current specifications.

Hardening

Heat-treatment involves three distinct phases—first, the heating of the alloy to the specified temperature; secondly, cooling it rapidly from this temperature, usually by quenching; and thirdly, aging, either spontaneously at ordinary temperatures or as a result of low-temperature reheating. The first two operations together are known as solution-treatment. Formerly this treat-

ment was referred to as "normalising" but this word has a different meaning in the heat-treatment of steel and it is therefore not applied to light alloys to-day. The spontaneous hardening operation is correctly called precipitation-treatment or temper hardening, while, less correctly, it is sometimes known as "artificial aging." The correct solution-treatment temperatures for each alloy are given, while another table provides a rough guide to the soaking times necessary for material of different thicknesses. Information is included regarding conditions for precipitation-treatment, and commercial annealing conditions for the strain-hardened alloys are summarised. Under the latter head, it is pointed out that the strength of heat-treated metal which has been softened by annealing, or super-annealing, must be restored by the appropriate re-solution treatment, before the parts go into service. The bulletin contains useful notes on workshop practice dealing with temperature; control of materials; degreasing the work; loading; quenching; refrigeration; and stove enamelling.

Advisory Service

Assistance on problems involved in heat-treating or any other aspect of light alloy manipulation is freely given to all inquirers through the Advisory Service Bureau of the Wrought Light Alloys Development Association, Union Chambers, 63 Temple Row, Birmingham, who have included do's and dont's for heat-treatment in the bulletin. This is printed on the inside covers of the book so the information is readily accessible to non-technical personnel and can be posted up in all works. Copies of the bulletin are available on application to the Association.

Beryllium in America

Increasing Demand

THE war metallurgical committee of the National Academy of Sciences and the National Defence Research Council has issued a report on beryllium. The report states that consumption of beryllium ore which was imported chiefly from Brazil and Argentina, in 1941 totalled about 2500 tons. The present stock is now about the same figure and can last through the summer at present consumption rates. About 6000 tons of ore are needed in 1943 and can reasonably be expected. More than 90 per cent. of the demand for beryllium is for copper alloys. Currently, the production of beryllium copper master alloys containing about

4 per cent. beryllium is at the rate of 3 million lb. a year, the demand appearing to be some 40 per cent. above the supply. However, expansion of facilities for producing master alloy are under way and should be sufficient to produce 10 million lb. annually. No corresponding expansion is projected for other beryllium products. The chief use of the metal, the report states, is for beryllium-copper alloy, making available a strong, heat-treated metal, suitable for electrical contacts, clips, small springs, diaphragms, etc. For the output of copper-base alloys containing beryllium, a so-called master alloy containing about 4 to 4½ per cent. beryllium is first produced. The final copper-base alloy has a beryllium content varying from about 0.3 to 2.5 per cent.

Prospecting with Ultra-Violet

The Search for Scheelite

THE heavy demand on tungsten for war purposes has increased the need for finding new sources of wolframite and scheelite. The latter, a form of calcium tungstate, fluoresces under ultra-violet light, which therefore makes it possible to identify this mineral in the field with ease. A useful account of the technique is given in *Deco Trefoil* (1943, 7, 1, p. 6) by V. L. Eardley-Wilmot, Mines and Resources Department, Ottawa, who states that it is only within the past year that the importance of the short wave ultra-violet mercury vapour lamp for the detection of scheelite has been fully appreciated by Canadian mining engineers and prospectors. The writer recommends a prospecting lamp weighing $1\frac{1}{2}$ lb. complete with battery for the purpose. Scheelite fluoresces a characteristic bluish-white, though occasionally other minerals may be encountered that give almost exactly the same fluorescence; these include cerussite, diopside, wollastonite, hydrozincite (zinc carbonate), some varieties of opal, calcite, dolomite, brucite, barytes, and gypsum. Some lichens and mosses also fluoresce in this manner, as do many oils and greases, but after a little experience the glow from oil and grease can be recognised.

If scheelite contains 0.35-1 per cent. of molybdenum the fluorescence is changed to white; if over 1 per cent. of Mo is present it is pale yellow, and the intensity of the yellow increases as the Mo content increases. In America, the Geological Survey has prepared standard colour cards which enable the amount of molybdenum to be gauged by comparison. The standard blue-white fluorescence is given by the great majority of Canadian scheelites, but the intensity varies. Some of the scheelite in the Gilmour Lake area gives a very dim greenish fluorescence that can be seen only close to the lamp, but the mineral has the same tungsten content as ordinary scheelite and when finely powdered its fluorescence is normal. Some scheelites containing copper fluoresce green.

Daylight Apparatus

For working in daylight the writer states that he uses a light-weight hood of black cloth, into the top of which the head is inserted, and ties the hood round the neck. Near the bottom of the hood is a flexible wire hoop about two feet in diameter, and about a foot from the bottom two arm-holes with sleeves are fitted, through which the forearms and the lamp can be inserted. The frill below the wire hoop shuts out light from irregular surfaces. Observations

can thus be made rapidly and even in sunlight, and the hood is cool, weighs only a few ounces, and folds into a small flat package. By the use of the lamp a fairly close approximation to the percentage of WO_3 in a scheelite deposit can be obtained. The exposed area is thoroughly cleaned, divided by chalk lines into sections, and the surface area of the mineral lump measured. The percentage of WO_3 is the total of the scheelite areas in square inches, divided by the total area of the vein surface measured in square feet, and multiplied by 1.2. The scheelite areas are measured by comparing with a standard card on which are marked or punched a number of squares or circles, varying in size from 3 sq. in. down to 0.01 sq. in. The best estimations are obtained with scheelite areas of 1-0.01 sq. in.; with larger areas the estimates are apt to be erratic unless large surfaces are examined. Note should also be taken as to whether the scheelite is massive or occurs only as thin layers along fractures, as in the latter case over-estimation is likely unless corrections are made. Grading of finely disseminated scheelite is difficult.

Australian Practice

According to an article in *Chemical Engineering and Mining Review* (1943, 35, 413, p. 123) attempts had been made from time to time in Australia to obtain fluorescence in specimens of scheelite by the action of ultra-violet light, but all the results were negative. Various suggestions were made to explain this failure, e.g., that Australian scheelites might not contain an impurity present in some of the foreign scheelites. As the result of investigations carried out by the Minerals Resources Branch of the Department of Supply and Development it is now established that all Australian scheelites do fluoresce under suitable conditions. The Australians are using a quartz mercury-vapour lamp operating at about 3000 volts and using a current of about 50 millamps. The lamp has its electrodes set wide apart and employs a cold arc. The auxiliary equipment includes transformer and choke coil connected to a 240 volt a.c. supply. About 80 per cent. of the total emission of these lamps is in the spectral line at 2536.5 A.U. To filter the ultra-violet light from the visible light a solution of iron-free cobalt-nickel sulphate in a quartz container 4 cm² in thickness is used. This "liquid filter" is made by dissolving 47 gm. nickel sulphate and 14 gm. cobalt sulphate in 100 c.c. of water, the best results being obtained when the reagents are chemically pure. With this

filter ultra-violet light down to about 2350 A.U. is obtained, although the intensity begins to fall off about 2411 A.U. On the upper wave-length side it does not appear that such a filter transmits appreciably above about 3300 A.U. This equipment is found very satisfactory, and has been used for routine testing of a large number of scheelite specimens, the beam of ultra-violet light being sufficiently broad to cover the surface of large specimens. It has been found that no fluorescence can be obtained when the wave-length of the ultra-violet light is greater than 2750 A.U. Pure calcium tungstate, under light of 2350-3300 A.U. (*i.e.*, using the cobalt-nickel sulphate filter), gave a fluorescence similar to that obtained with specimens of the mineral, suggesting that scheelite fluorescence is not due to the presence of an impurity but to an intrinsic property of calcium tungstate. The method offers a ready means of prospecting for scheelite underground. It is only necessary to traverse a mine with the ultra-violet light, when the scheelite will be conspicuous by its characteristic glow. The technique is so rapid that it is considered worth applying in all mines where the regional geology suggests the remotest chance of scheelite occurrence. It is possible to devise a quantitative method equivalent to sampling. The ratio of the area of fluorescence in a rock face to the total

area of the face is an approximate measure of the grade, provided that allowance is made for the densities of the scheelite and the gangue. If this area ratio is converted to a percentage and denoted by s then the weight per cent. of WO_3 is given by $483.6 s / 6 s + g (100 - s)$, g being the relative density of the gangue, and the scheelite being assumed to have a relative density of 6 and to contain 80.6 per cent. of WO_3 .

It is of interest to note that the face of the stope can be photographed in ultra-violet light, providing a permanent record of the fluorescent areas which can be measured on the photograph by planimetric methods so enabling the grade of the deposit to be determined afterwards.

Use has also been made of ultra-violet light to increase efficiency in the hand-picking of scheelite ores. In this type of work ultra-violet lamps are arranged over the belts where the hand-picking is done, in such a way that the no direct ultra-violet light reaches the eyes of the workmen. In such work a powerful ultra-violet lamp operated from a power supply is normally required. It is also considered that ultra-violet light could be used in the continuous checking of certain milling processes; for example, in examining scheelite in movement on shaking tables.

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Analysis of Fluorspar

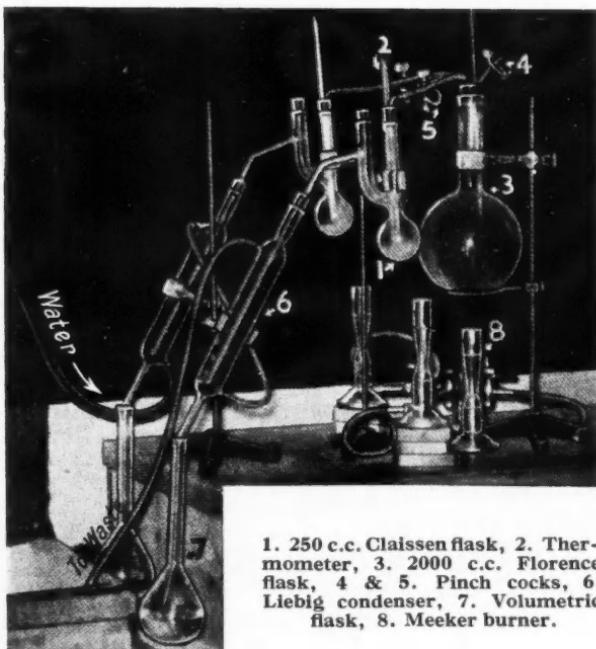
Comparison of Three Alternative Methods

A COMPARATIVE account of three methods of analysing fluorspar by Mr. G. L. Frayser, a chemist with 20 years' experience in this type of assay work, is published in *Deco Trefoil* (1943, 7, 2, p. 5). Mr. Frayser points out that it is one of the most difficult minerals to assay. It may be noted that in America the specifications for fluorspar are exacting; for metallurgical

flask, a centigrade thermometer, a 200 c.c. Florence flask, two pinch cocks, a Liebig condenser, a volumetric flask, and a Meeker burner. A number of stills can be operated from a single 2000 c.c. Florence flask, and the illustration shows two stills operated from one Florence flask.

The necessary reagents are perchloric acid, 70 per cent.; thorium nitrate, 0.1 N, standardised by titrating the fluorine obtained by distillation of 100 per cent. natural cryolite or sodium fluoride, using the procedure given below; sodium alizarin sulphonate, 0.05 aqueous solution; 2 per cent. sodium hydroxide solution; hydrochloric acid, 1 in 200; and buffer solution, consisting of 9.488 grams of monochloroacetic acid, and 2 grams of sodium hydroxide in 100 c.c. of water.

A 0.2 gram sample is transferred with the aid of a little water to the 250 c.c. Claissen distillation flask (1), containing 8-10 glass beads. Adjust the volume to approximately 30 c.c. and add 25 c.c. of perchloric acid. Close the flask with a two-hole rubber stopper, through which passes a thermometer, and a 4-mm. glass tube which extends down into the



1. 250 c.c. Claissen flask, 2. Thermometer, 3. 2000 c.c. Florence flask, 4 & 5. Pinch cocks, 6. Liebig condenser, 7. Volumetric flask, 8. Meeker burner.

purposes fluorspar gravel must contain not less than 85 per cent. CaF_2 , and not more than 5 per cent. SiO_2 : in hydrofluoric acid manufacture the percentage of CaF_2 must be at least 97.5, while the limits for silica and ferric oxide are set at 1.5 and 0.5 per cent., respectively. The standard for ceramic fluorspar is almost as high.

The first method he describes is the Willard-Winter method introduced for the determination of fluorine in phosphate ores and adapted for use in the fluorspar industry by the Aluminum Research Laboratories. The apparatus required includes a distillation chain, comprising a 250 c.c. Claissen

solution. The 4 mm. glass tube connects the still with a 2000 c.c. Florence flask containing water, which is heated to generate steam. This Florence flask is equipped with two discharges, (4) to release steam and (5) to discharge steam into the still.

Connect the distillation flask (1) to the Liebig condenser, and distil until the solution reaches 135°C . While this is being done bring the water in the steam-generating flask to the boil by adjusting the burner with the steam release (4) open. When 135°C . is reached in the Claissen flask (1), admit steam by opening (5) and closing (4),

and regulate its flow so that the volume of the solution in the still is held constant. Adjust the heat applied to the still so that a temperature of 135°C. is maintained, and continue the distillation until 250 c.c. of the distillate is collected in the volumetric flask. Take an aliquot of 100 c.c. (0.08 of the sample). Add 5 drops of indicator. Adjust the acidity back and forth with 2 per cent. NaOH and 1 in 200 HCl, finally leaving the solution just acid and the pink colour discharged. Add 1 c.c. of the buffer solution and titrate with 0.1 thorium nitrate to a permanent pink.

Then 1 c.c. 0.1 N thorium nitrate = 0.0019 gram fluorine.

$$1 \text{ c.c. thorium nitrate} \times 0.0019 \times 100 = \\ 0.08$$

percentage of fluorine.

Percentage of fluorine \times 2.0545 = percentage of fluorspar.

The Willard-Winter method has been widely adapted to fluorspar ores because none of the impurities such as sulphides, clays, micas, and barytes interfere with the fluorine determination. An ore which is rich in sulphides will produce a cloudy distillate, but this can be overcome by making it alkaline and filtering.

The Schwerin Method

The second method, devised by Lenher Schwerin (1940), is a rapid method for determining carbonates, calcium fluoride, and silica in fluorspar containing no sulphides. Mr. Frayser says that it gives high fluoride results in the presence of mica-schists. A 0.5 gram sample, fine ground, is digested with 10 c.c. of 10 per cent. acetic acid in a glass beaker on a water bath for an hour and a half. Filter through ashless paper, wash residue and paper three times with hot water, ignite and weigh. The loss of weight represents the carbonates. To determine the CaF_2 , add to the residue in a glass beaker 15 c.c. of 20 per cent. perchloric acid saturated with boric acid at 50°C. Heat gently until fumes of perchloric acid come off for 4-5 minutes. Add 10 c.c. of water and repeat the fuming for 4-5 minutes. Dilute to 50 c.c. and after bringing the solution to the boil filter through ashless paper. Wash first with a dilute solution of perchloric acid and then with hot water until free of calcium perchlorate. Transfer the residue in the filter paper to a tared platinum crucible; add 2 drops concentrated H_2SO_4 and ignite. Loss in weight represents CaF_2 .

The final method, introduced by Dr. Bidtel in the Illinois fluorspar district in 1913, is useful for high-grade ores, but with ores containing such impurities as sulphides, clays, micas, or barytes the analysis may indicate that the ore is of a higher grade than is actually the case.

Synthetic Oil in Manchuria

Hydrogenation Plant behind Schedule

ALTHOUGH Japanese plans called for a great increase in the Manchurian production of synthetic oil from coal (1,700,000 tons annually), only four small plants have been built. One hydrogenation plant in Fushun, with a total capacity of 20,000 tons of oil annually, began operations late in 1940 under control of the South Manchurian Railway. Hydrogenation plants on an industrial scale, with a capacity of 300,000 tons of oil a year, were built in Kirin for the Noguti concern, but at the end of 1941 no oil had been processed. Still under construction were plants for hydrogenation and low-temperature carbonisation in Syipingai, under control of the Mansyu Yuka Koge Co., and the plant for gas synthesis in Tazinzhou, under control of the Mansyu Gosei Nenre Co.

To augment shale-oil output to 650,000 tons a year by 1941, it was proposed to expand the Fushun plant considerably. According to official reports of the South Manchurian Railway, production capacity of the plant was stepped up to 360,000 tons by March, 1939. Actual production was much smaller, however, and shipments to Japan did not advance to any great extent. Reports indicate that output of fuel oil in Manchuria rose only 60 per cent. from 1936 to 1941.—*Foreign Commerce Weekly*.

SCIENTIFIC FILM ASSOCIATION FORMED

The English Scientific Film Association was formed on May 15 at a meeting representative of science and films, convened by the Scientific Film Committee of the Association of Scientific Workers. Mr. Arthur Elton was in the chair. He stated that the new association would be independent and self-governing. An interim planning committee was appointed to frame the constitution and to propose conditions of membership, contact having already been made with the equivalent Scottish Association. The acting secretary is Mr. M. Michaelis, 51 Fitzjohn's Avenue, London, N.W.3. The English Scientific Film Association aims to promote the use of scientific films in order to achieve the widest possible understanding of scientific methods and outlook, especially in relation to social progress, and it will collect, collate, and distribute information on such films by publishing comprehensive lists of scientific films graded according to scientific merit.

It will also support a representative panel of scientists to advise producers of films of all types on scientific matters in connection with their films and to maintain close contact with the film industry.

General News

Production of liquid oxygen explosives for blasting purposes is under study in Eire.

From 20 to 30,000 tons of waste lime from a local sugar beet factory were used last year by Worcestershire farmers.

The telephone number of the Gauge and Tool Makers' Association is now REGent 3451/2. The offices remain at Standbrook House, 2/5 Old Bond Street, London, W.1.

Birmingham Metallurgical Society last week appointed its officers for the year: Mr. L. W. Law, president; Mr. W. L. Gouver, Mr. N. F. Fletcher, Mr. L. C. Batchelor and Dr. T. Wright, vice-presidents; Mr. A. C. Craig, treasurer; Mr. F. G. Tustin, secretary.

Synthetic rubber in large quantities is not available in Britain, and if it were there would be some things—notably the casings of giant tyres—that could not be made satisfactorily from it, said Lord Rothes, director of tyres, at Birmingham last week.

During April approximately 50,000 employees of 680 firms and organisations in England and Wales became contributing members of the Red Cross Penny-a-Week Fund. In the same month more than 70,000 existing industrial contributors voluntarily increased their weekly contribution.

The "black-list" of specified persons, at present embodied in four Orders, has been published in a new consolidating Order under the title of the Trading with the Enemy (Specified Persons) (Amendment) (No. 7) Order, 1943 (S.R. and O., 1943, No. 692, price 3s. 9d.).

Officers of the Nutrition Society, who were re-elected at the meeting on May 22, were Sir John Orr (chairman), Dr. L. J. Harris (secretary), Mr. A. L. Bacharach (treasurer). Dr. S. K. Kon was elected honorary editor, and Mr. F. Le Gros Clark, Professor S. J. Cowell, Dr. A. P. Meiklejohn and Dr. Lucy Wills were elected to the committee.

The use of selenite for purposes now served by window glass was described by Mr. C. E. N. Bromehead at a meeting of the Mineralogical Society on June 3. He pointed out that it was thus employed in Europe till the 17th and in South America till the 19th century, and it was probably the *lapis specularis* of the ancients.

The Minister of Food has issued a General Licence under the Saccharin (Control and Maximum Prices) Order, 1942, authorising manufacturers to use, until July 24, for the manufacture or preparation of food any stocks of saccharin solution, dulcin solution, saccharin in powder form, dulcin, soluble saccharin or sweetening powder of which delivery was taken on or before May 29.

From Week to Week

The prophecy that cast-iron, once regarded as one of the cruder engineering materials, will be lifted by research to quite another plane was made at the formal opening of the new headquarters of the British Cast Iron Research Association last week. Formerly housed in St. Paul's Square, Birmingham, the association has now moved out to a Worcestershire country house.

The Medical Research Council intends to establish at London Hospital a department for research in industrial medicine, with Dr. Donald Hunter, physician to the hospital, as physician-in-charge. The primary aim is to undertake clinical researches into disorders affecting industrial workers, including occupational diseases and others of a more general kind.

The Minister of Fuel has set up a committee to advise him on the measures to be taken to provide for the medical treatment of miners in the Wales Region (which includes the coalfields of Bristol, Somerset, and the Forest of Dean), who are suffering from pneumokoniosis. Mr. William Jones, C.B.E., is chairman of the committee, which held its first meeting on May 28.

The importance of colour in maintaining morale and of colour co-ordination in national economy are stressed in the annual report of the British Colour Council and in the speech of the chairman at the annual meeting. It is also emphasised that craftsmanship must be maintained if Britain is to develop an export trade after the war. Useful exhibitions and lectures have been held in various centres throughout the year.

Owing to a shortage of surplus potatoes, the Irish alcohol factories in Donegal are unlikely to produce this season. The operating company is, however, to undertake the manufacture of ether at the factory at Cooley (Louth), adapting the machinery which has been used for making formalin during the last two seasons (see THE CHEMICAL AGE, April 17, p. 430). During the season just ended, 3000 gallons of formalin were manufactured there.

A manufacturers' memorandum on Neoprene (No. M.6) has been issued in the Services Rubber Investigations series, the research on which it is based having been carried out by I.C.I. (Dyestuffs), Ltd., on behalf of Government departments. This useful pamphlet gives full particulars of compounding, processing, mixing, etc., the various types of Neoprene, and inquiries in connection with it should be made either to the Ministry of Supply (S.R.5b), Berkeley Court, Glenthorne Street, London, W.1, or to Dr. W. J. S. Naunton, Hexagon House, Blackley, Manchester, 9.

Foreign News

The German optical glass and precision instrument industry was the target of Mosquitos of the R.A.F. on Thursday last week, when the instrument works of Carl Zeiss and the glass plant of Schott and Gnossen, both at Jena, were heavily bombed at dusk.

The strike by 8000 nitrate workers in Antofagasta, Chile, has ended, following the Government's declaration that it is illegal, says Reuter. The dispute arose over the raising of food prices in the nitrate companies' shops.

Synthetic oil plants of Ruhr Chemie A.G., and its allied company, Ruhr Benzin A.G., both at Sterkrade, 6 miles N.E. of Duisburg, were among recent targets of the R.A.F. It is believed that the plants will be out of action for a considerable time.

Shortage of refrigerants, such as ammonia, is causing difficulties in the working of ultra-deep mines in the Rand. The question of this type of mining is to be investigated by a commission appointed by the South African Minister of Mines.

Exports of gold from Kenya, which are approximately equal to total production, rose from 101,149 oz. (av.), in 1939, to 115,908 oz. in 1941, according to a statement by the Minister for the Colonies in the House last week. Information so far received suggests that production declined in 1942.

Doctors in America will soon be using more penicillin as an anti-bacterial agent, according to Dr. Geiling, of the University of Chicago. Hitherto, high cost of production has greatly restricted the use of the drug, but improved methods of producing it are already making large quantities available.

The state of Finland's chemical industry is to be examined by a commission, set up by the Council of State, which will probably be expanded later into a permanent organisation which will pass on proposals submitted for the installation of new chemical factories or expansion of existing works.

Insoluble synthetic resins are included in the raw materials section of the Uruguayan tariff, dutiable at 5 per cent., plus a surtax of 4 per cent. of a fixed official customs valuation of 0.80 peso per kilogram, according to a resolution of January 29, 1943, published in the Diario Oficial of March 4.

Germany's chemical industry received a heavy blow last Saturday, when 1500 tons of high explosives were dropped on Wuppertal by R.A.F. bombers. One of the largest factories in Wuppertal is the I.G. works at Elberfeld (one of Wuppertal's component townships), where, before the war, pharmaceuticals, including synthetic quinine, and dyes and colours were manufactured.

Ammonium nitrate, produced in Ontario and hitherto chiefly employed in explosives manufacture, is being used as a fertiliser in the Central and Southern United States. The fertiliser is in the form of a mixture containing 34 per cent. of nitrogen, associated with limestone.

A 25 per cent. rise in production in Russia's second largest oil producing area between the Volga and the Urals, known as Russia's "second Baku province," is expected this year. A number of new wells, refineries, and ancillary buildings have been constructed.

The chairman of the U.S. Senate Patents Committee, has written to the minority stockholders' committee of the Standard Oil Company, endorsing the committee's resolution calling on the company not to renew the cartel arrangements with the German I.G. Farbenindustrie after the war, says Reuter.

The new Government-owned magnesium plant at Spokane, Washington, has gone into production, announces the U.S. War Production Board. When it is in full production at the end of this year it will have an output approximately four times as great as the entire annual pre-war production of the United States.

Forthcoming Events

A meeting of the Northern section of the **Institute of the Plastics Industry** has been arranged for **June 5**, at 2 p.m., at the Engineers' Club, Albert Square, Manchester, when a paper will be read by Mr. A. Renfrew, B.Sc., on "Thermoplastics."

The annual general meeting of **The Institution of Gas Engineers** will be held at Grosvenor Place, London, on **June 9**, starting at 10 a.m.

It has been decided by the Road and Building Materials Group, **Society of Chemical Industry**, to repeat in London, the paper recently given in Manchester by Mr. G. H. Fudge on "The War-Time Replacement of Asphaltic Bitumen by Tar Products." This will be given at 6 p.m., on **June 9**, at 1 Grosvenor Place, London, S.W.1.

The Tees-Side section of the **Royal Institute of Chemistry** announces that on **June 10**, at 7 p.m., over Sparks' Café, 143 High Street, Stockton-on-Tees, Dr. G. Roche Lynch will speak on "Some Medico-Legal Experiences."

The **Institute of Chemistry** (London and S.E. Counties section) will hold a meeting, at 6 p.m., on **June 16**, at 30 Russell Square, W.C.1, when Dr. W. T. J. Morgan, F.I.C., of the Lister Institute, will lecture on "Some Recent Advances in Immuno-Chemistry."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ALUMILITE AND ALZAK, LTD., London, W., metallurgists and engineers. (M., 5/6/43.) May 17, £10,000 (not ex.) debenture, to Martins Bank, Ltd.; general charge. *Nil. January 14, 1942.

CONSOLIDATED CHEMICALS, LTD., Bury St. Edmunds. (M., 5/6/43.) May 6, £2000 debentures; general charge.

Satisfactions

BRITISH INDESTRUCTO GLASS, LTD., London, N.W. (M.S., 5/6/43.) Satisfaction May 17, of debenture, registered October 26, 1942.

STEATITE & PORCELAIN PRODUCTS, LTD., Slough. (M.S., 5/6/43.) Satisfaction May 13, of debentures registered May 3, 1933, to the extent of £5800.

Deed of Arrangement

BLEVINS, THOS., 11 Wellington Road, Newark-on-Trent, trading at Cross Street, Newark, as J. J. Blevins and Son, chemical engineer. (D.A., 5/6/43.) Dated May 14, filed May 21. Tr. F. E. Bendall, 48-50 Exchange Buildings, New Street, Birmingham. secured Crs., £368; liabilities unsecured £5044; assets, less secured claims, £2688.

Company News

Dussek Brothers and Co., Ltd., announce an interim dividend of 4 per cent. (same).

Wailes Dove Bitumastic, Ltd., are paying an interim dividend of 5 per cent. (same).

Johnson, Matthey and Co., Ltd., announce a dividend of 7 per cent., making 10 per cent. (same).

The profit of **B. Laporte, Ltd.**, for the year ended March 31, 1943, was £145,920 (£134,345), and the ordinary dividend 5 per cent., making 7½ per cent., as already announced.

Chemical and Allied Stocks and Shares

DESPITE the small volume of business which has continued to rule in Stock Exchange markets, the general undertone in security values was fairly steady. In

various directions moderate declines were shown on balance, but this was due to the small demand in evidence. In fact, there was again no heavy selling, and sentiment generally was assisted by the better tendency which has been maintained in British Government securities. The view prevails that markets seem likely to remain inactive in most sections pending the next big war development. Imperial Chemical at 38s. 7½d. were virtually the same as a week ago, while Dunlop Rubber were 34s. 6d. x.d., the last-named having remained more under the influence of the reduced trading profits for the past year than the maintenance of the dividend. Lever & Unilever were lower at 34s., but at the time of writing Lever N.V. have shown further improvement from 31s. 9d. to 32s. 3d.

Elsewhere, in accordance with the tendency which has ruled in most industrial securities, British Aluminium eased to 49s. 9d. British Oxygen were 76s. 3d., and Amalgamated Metal shares reacted to 17s. 6d. There was a reactionary trend in British Plaster Board 5s. shares, which have moved down to 27s. 3d. at the time of writing; but, as in other directions, the lower price was attributed mainly to reduced demand, no heavy selling having been in evidence. Financial results of the last-named company are due in July. Barry & Staines remained at the lower level of 41s. recorded a week ago; this is another instance where the prevailing disposition is to await the dividend announcement. Allied Ironfounders at 47s. 3d. lost a further part of their recent improvement, awaiting the financial results. On the other hand, Goodlass Wall remained under the influence of the improved distribution of 7 per cent.; these 10s. shares changed hands around 14s. 7½d. Elsewhere, Turner & Newall showed a better tendency at 76s. 6d.

B. Laporte remained firm at 78s. on the full results, which show that the 7½ per cent. tax free dividend is a conservative payment. It requires £24,375, and permits £10,000 to be placed to reserve, while the balance carried forward is raised by £17,928 to £55,472. W. J. Bush were higher at 53s. 9d.; the 5 per cent. £5 preference shares have changed hands at slightly over £5½. British Drug Houses were 20s. x.d. on further consideration of the dividend. In other directions, Greeff-Chemicals 5s. ordinary were quoted at 7s. 3d. Monsanto Chemicals 5½ per cent. preference remained at 22s. 6d. British Glues 4s. ordinary were higher at 7s. 10½d., awaiting the results; the 8 per cent. participating preference changed hands at 32s. 3d. at one time.

Iron and steel issues reflected the easier trend of markets, but in most cases, declines did not exceed more than a few pence on balance. Guest Keen were 33s. 3d.,

Babcock & Wilcox 48s. 3d., Stewarts & Lloyds 5ls., Tube Investments 93s. 3d., and United Steel 26s. 7½d. Elsewhere, General Refractories had a steadier appearance at 15s. 6d., but Nairn & Greenwich moved back to 65s. 7½d., and Borax Consolidated deferred eased to 34s. 3d. Imperial Smelting at 14s. 4½d., however, maintained their recent improvement. Among other securities, the units of the Distillers Co. reacted to 84s. 9d. under the influence of the general market trend; the view prevails that the forthcoming results are likely to show maintenance of the dividend at 16½ per cent. United Molasses at 29s. had a relatively steady appearance, while Wall Paper Manufacturers' deferred units were steady, having maintained their recent rally to 36s. 9d. at the time of writing. Among plastics, British Industrial were again 5s. 10½d., Lacrinoid Products 4s. 4½d., and Erinoid 11s. 4½d. Elsewhere, Fisons changed hands up to 48s. 6d., Wm. Blythe 3s. shares around 8s. 6d., and Burt Boulton at 19s. 6d. Oil shares were inactive and slightly lower on balance.

British Chemical Prices

Market Reports

MOST traders report reasonably satisfactory conditions on the chemical market, taking into consideration the difficult supply position in several sections. With regard to the price position there has been no apparent easiness in any direction and in most instances the undertone is very firm. In the soda products section the demand for caustic soda has been on steady lines, while there has been no quotable change in the position of chlorate of soda, supplies of which are insufficient to meet current requirements. Among the potash chemicals, British makers of permanganate of potash are well booked and supplies of the pharmaceutical and technical qualities are being promptly disposed of. Inquiries for acid phosphate of potash have been on steady lines. In the acid section the movement of sulphuric acid into consumption remains very active, while a good call for supplies of hydrochloric is being met by producers. Oxalic acid is in good request and supplies remain scarce. Conditions in the market for coal-tar products show little change. Contracts for cresylic acid are being steadily drawn against, while a continued demand is reported for the toluols and benzols.

MANCHESTER.—The only price advances of any consequence on the Manchester market for chemical and allied products during the past week have been in the white and red lead ready-mixed paints, which have moved up by £1 per ton, and in the white and red leads ground in oil, which are 10s. per ton

dearer, the dry products being unchanged. These advances came into force on Tuesday last. The alkali and other heavy chemicals maintain their firmness, but prices are much the same as before, and for the most part contract deliveries are being called for. There has been a fair amount of new inquiry about during the week and the new business booked has been of moderate aggregate extent.

GLASGOW.—Business in the Scottish heavy chemical trade has been rather quiet during the past week for home business. Export trade is still rather restricted. Prices remain very firm, with no actual changes.

Latest Oil Prices

LONDON.—June 2.—For the period ending June 26, per ton, net, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies : LINSEED OIL, crude, £50. RAPSEED OIL, crude, £58. COTTONSEED OIL, crude, £39 12s. 6d.; washed, £42 15s.; refined edible, £57; refined, deodorised, £58. COCONUT OIL, crude, £36 12s. 6d.; refined deodorised, £49. PALM KERNEL OIL, crude, £36; refined deodorised, £49; refined hardened deodorised, £53. PALM OIL, refined deodorised, £55; refined hardened deodorised, £58. GROUNDNUT OIL, crude, £44; refined deodorised, £58. WHALE OIL, crude hardened, 42 deg., £39; refined hardened, 42 deg., £51. ACID OILS—Groundnut, £27 10s.; soya, £25 10s.; coconut and palm-kernel, £31. ROSIN, 26s. 6d. to 33s. per cwt., ex wharf, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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Vertical Copper STEAM JACKETED MIXER; pan 3 ft. 0 in. dia. by 2 ft. 0 in. deep; fitted with bow and scraper mixing gear, overdriven through bevel and spur gearing from f. & l. pulleys; arranged with rise and fall steering mechanism, driven by three speed belt from main drive; bottom run-off to pan.

Vertical Copper STEAM JACKETED TILTING PAN MIXER by Morton; pan 2 ft. 0 in. dia. by 1 ft. 10 in. deep; bronze bow and scraper type agitating gear and arranged with mechanically operated rise and fall mechanism; final drive through gearing from f. & l. pulleys.

Vertical Copper STEAM JACKETED MIXER by Hartley; pan 2 ft. 0 in. dia. by 1 ft. 6 in. deep; bow and scraper type mixing gear overdriven and arranged with mechanically operated rise and fall mechanism; final drive through gearing from f. & l. pulleys.

Vertical Copper STEAM JACKETED TILTING PAN MIXER by Brierley, Collier & Hartley; pan 1 ft. 9 in. dia. by 1 ft. 4 in. deep; arranged with bronze bow and scraper agitating gear and power operated pilot rise and fall mechanism; final drive through gearing from f. & l. pulleys.

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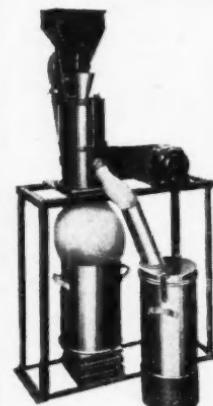
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